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THE SELF-REPORTED MOTIVATIONAL QUESTIONNAIRE (SMQ):

A Preliminary Validation Study with a Population of  
Enlisted Submariner Volunteers

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Bureau of Medicine and Surgery, Navy Department

Research Project MR005.14-2100-2.04

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## **SUMMARY PAGE**

### **THE PROBLEM**

To investigate the reliability and validity of an experimental paper-and-pencil test designed to measure certain aspects of the motivation of enlisted volunteers for basic submarine training.

### **FINDINGS**

The Self-Reported Motivational Questionnaire (SMQ) is usefully reliable. It is a valid predictor of Submarine School attrition for that portion of the population which falls below the median in aptitude (combined Arithmetic and Mechanical Test scores). Final Submarine School standing correlates significantly with the SMQ only for the "low" aptitude group.

### **APPLICATION**

These findings suggest that the SMQ can be utilized successfully in the screening process for enlisted Submarine School.

### **ADMINISTRATIVE INFORMATION**

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## ABSTRACT

The construction and keying of the Self-Reported Motivational Questionnaire (SMQ) are described. With enlisted Submarine School volunteers the scores are related to attrition in Submarine School. These relationships are presented with several breakdowns such as rated/non-rated, high/low scores on the Basic Test Battery, and are described in detail. The discussion of the reliability and validity of the SMQ conclude, that the scores are usefully reliable, and that they are usefully valid for that portion of the population whose aptitude (ARI + MECH) is below the median for the total population. The final academic rank order of the 1100 Submarine School graduates studied is significantly correlated with the SMQ only for the "low" aptitude group.

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# THE SELF REPORTED MOTIVATIONAL QUESTIONNAIRE (SMQ):

## A Preliminary Validation Study with a Population of Enlisted Submariner Volunteers

### INTRODUCTION

Motivation is a general term referring to behavior that is instigated by needs and directed toward goals (6, 10). Motives may be defined as conditions of an individual that dispose him to act in certain ways, these conditions being either physiological or psychological in origin (3).

Although the majority of past studies dealing with motivation have concentrated on animal behavior, in recent times more stress has been placed on the role of motivation in human life and the relationship of motivation to man's accomplishments. Maslow (5) has postulated that most basic human motives can be classified into five categories including physiological, safety, love, esteem needs and the need for self-actualization.

Some investigators feel that it is important to distinguish motivation from the concept of attitude to which it is very closely related. It may be assumed that attitudes are dependent upon motivation for their affective loading. This affective loading, in turn, is the resultant of the degree to which the "object" of the attitude is instrumental in the achievement of significant goals. Thus, differences between attitudes may account for the persistence and intensity of motivated behavior. Attitudes may also determine the direction that motivated behavior will take and are important in controlling motivation (7). However, for the purpose of this particular study, it was not felt to be necessary to distinguish the effects attitudes have on motivation, or vice versa. In fact, it is assumed that attitudes are a particular class of motives and, therefore, attitudinal evaluation becomes an integral part of the total evaluation of motivational structure.

Motives also play an important role in the learning process as they energize behavior, i.e., they release energy and arouse activity. They may also be considered as

selectors and determiners of situations which materially affect the learning process (3).

The following statement gives an excellent summary of the role of motivation in human behavior. According to Maslow "...a healthy man is primarily motivated by his needs to develop and actualize his fullest potentialities and capabilities". (5, p. 105). Thus, one characteristic of human motivation is that it orients behavior along lines commensurate with a person's potentialities and capabilities.

But how are motives to be measured? In the first place, motives are never directly observable, but must be inferred from overt acts (4). One approach to motivational evaluation is based upon the assumption that free associative, unguarded thought provides the "richest" source of evidence concerning human motives. Accordingly, humans are exposed to unstructured or semi-structured stimuli and from their responses certain aspects of their motivational structure are inferred. Along similar lines, studies have been conducted to ascertain the effects of arousal of motivation upon imaginative thought as well as the effect of individual differences in motive strength upon behavior (2).

Ritchie states that it is far easier to ask a person a question obtaining a "yes" or "no" answer than it is to submit him to behavioral tests in order to measure the presence or strength of motives. As a consequence, he concludes that it is preferable to give a verbal test to a behavioral test. He goes on to indicate, however, that there is need for validating projective techniques so that correct inferences can be made from the verbal reports (8).

The use of projective techniques in assessing the presence and strength of motivation cannot be denied as an important

method for gathering and describing motivational data. The direct method, on the other hand, assumes that a normal subject will tell you directly what is inferred from his responses to tests. Allport emphasizes that with well integrated personalities as much importance should be attached to their **conscious** verbal reports of emotions, wishes, desires and interests as is usually given to those motives uncovered by projective (indirect) methods, motives of which the individual is presumably unaware (1). The direct methods of motivational assessment include verbal reports as elicited in interviews, autobiographical methods when taken at face value, and paper and pencil tests which yield an overall score based on a series of choices made by the individual (1). This latter method is the approach used in this and some other studies on motivation conducted at the Naval Medical Research Laboratory.

In 1956 a study was undertaken to explore the motivation of submariner volunteers and their later success in Submarine School. Differences in patterns of responses to a motivational questionnaire were examined between various levels of achievement in Submarine School, between navy rates, and between those men who fail (drops) as well as graduates. The most significant differences in motivation occurred between drops and graduates. Those candidates who were dropped, or who de-volunteered, presented a distinctive motivational pattern characterized by lack of interest in Submarine School and submarine duty for that matter. From these results it appeared that a well designed motivational questionnaire might provide a means of

identifying volunteers with the inadequate motivational and other personality characteristics typical of those who are later dropped from school (13).

Recently, a study was published which examined the effectiveness of standardized measures of need and value systems, as well as an experimental motivational questionnaire. This questionnaire, the Self-Reported Motivational Questionnaire (SMQ), was designed to "tap" reasons for volunteering for the Submarine Service as well as more general attitudes toward the naval service. The scores from this questionnaire showed significant differences between the need systems of officers and enlisted men, and also differences within the officer group itself. Also the scores were found to be usefully predictive of Submarine School attrition within the officer group (10).

The encouraging results of this study conducted with officer candidates for the Submarine Service provided the impetus for the present study. Since the SMQ gave evidence of predicting attrition in officer groups, it was deemed necessary to investigate this method of assessing motivation for enlisted Submarine School volunteers. Therefore, the primary goals of the present study were to investigate the reliability and predictive validity of the SMQ in a population of enlisted volunteers, using Submarine School attrition rate as the criterion. In addition, a secondary goal of this study was to examine the important problem of the interaction of military rating, achievement level in Submarine School, and psychiatric status with motivation—again as they relate to the attrition criterion.

## THE SELF-REPORTED MOTIVATIONAL QUESTIONNAIRE

### Item Content and Response Format.

The direct method of measuring motivation was used in the construction of the questionnaire first developed for the officer study mentioned earlier (10). The items were aimed at obtaining responses relevant to the goals, values, interests and aversions of the volunteers. The working hypothesis underlying the construction of this questionnaire was that much of importance can be gleaned from simply asking a person his motives. It was assumed that many, if not most, of the goals and aspirations accounting for vocational choice, are known, or could be made known (10).

The following statement, quoted from the motivation study with officer candidates for submarine service, indicates the content of the 50 items making up the first form of the questionnaire (op. cit. p. 19):

In the first place, an attempt was made to tap the reasons for volunteering for the Submarine Service by the inclusion of such items as the possibility of accelerated promotional schedules, more favorable work environment, the possibility of more prestige by being a submariner and wearing the dolphins, the possibility of advanced technological training, and so on. Secondly, an attempt was made to include items designed to reveal attitudes toward the volunteer himself with respect to his potentialities as a submariner, and his wife's and/or parents' attitudes toward the dangers involved in submarining, and more general attitudes toward the opportunities and advantages of a Navy career. The third focus was to present items tapping interest in engineering and the technology peculiar to the Submarine Service. Finally the fourth area for which items were collected was aimed at evaluating the expectancies of the volunteer in terms of the difficulty of the technical training, how much glamour and excitement he expected in submarines, whether he an-

ticipated difficulty in passing the training tank and pressure chamber training, and so on.

A vertical ten-point rating scale with response categories ranging from "Not at all like me" to "Exactly like me" was used by the volunteer to indicate the degree to which each item described him at that time (Appendix A). The rationale for using this technique is as follows: "...it was believed that this technique would reduce the tendency to deny true or partly true items by virtue of the fact that the multi-category method allows the person to respond honestly. In addition to allowing more accuracy in describing oneself, it appeared probable that the threat of a true-false format for symptom items would be greatly reduced by the opportunity given a subject to admit that a particular item with negative connotations was, for example, only 'Somewhat like me'. On the other hand, admitting 'True' to the same item might have many threatening implications for the subject since his response might be interpreted as an admission of an extreme degree of the particular symptomatology (9, p. 2). Empirical evidence for the efficacy of the "barometer technique", as it came to be called, is contained in two publications by the Naval Medical Research Laboratory (9, 10).

### The First Item Analysis.

The enlisted men's scoring key, now in use, was derived from the original items suggested by previous studies (10, 13). The results of several internal consistency item analyses, made separately for officers and enlisted volunteers for the Submarine Service, indicated among other things the necessity to derive independent keys for each population. Accordingly, the first step in deriving the enlisted men's key was to analyze the responses to the 50 items obtained from 256 men. A total score for each questionnaire was obtained by adding their responses to 47 of these items.<sup>1</sup> Item-total score correlations (tetrachoric) were computed.



Using a 1% confidence level criterion ( $r_{\text{tot}} \geq 0.20$ ), 33 items remained in the first scoring key. Using this 33 item summed score as the next validation criterion, item-total correlations were again computed. Somewhat arbitrarily, items with correlations of + 0.30 or greater were accepted for the key.

An external validating criterion was also employed at this stage of the item analysis. Dichotomizing the population into those who failed and those who graduated made it possible to identify those items which reliably (5% confidence level) predicted Submarine School attrition.<sup>2</sup> The key resulting from the last "internal" and this "external" analysis contained 28 items, the sum of which gave the total score. Using this score, an odd-even reliability estimate of 0.87 was computed with the Spearman-Brown correction applied.

#### The Final Item Analysis Resulting in the Scoring Key Used in the Validation Study.

The original list of items was then revised, both by the deletion of some items and the addition of new ones. This revised form was administered to a second group of 469 volunteers and their responses scored with the second experimental key. The same technique of item analysis as employed in the preceding analysis was applied to these data (Chi-squares computed by Graduate/Drop criterion,  $N = 458$ , with 11 drops for physical reasons not included). Response distributions to each of the SMQ items were arranged in a 0-4, and 5-9 dichotomy. These operations resulted in the selection of 11 items whose item-total correlations were + 0.30 or more and whose  $X^2$  value was significant at the 10% level or better, and nine items with significant positive correlations, but with  $X^2$  values which were not significant. In addition, four other items were selected, three of which had high negative correlations and significant  $X^2$  and one item with a high negative correlation but with a non-significant  $X^2$ . A score used

in the final item analysis was computed by subtracting the sum of the four negatively-keyed items from the sum of the twenty positively-keyed items. Item-total score correlations were again computed, the result being the deletion of one item and the addition of seven new ones, some of which were experimental items, giving a final key of 26 positively scored and four negatively scored items. A "subtract" score, used in the validation procedures to follow was obtained in the same manner indicated above. A split-half reliability coefficient with the Spearman-Brown correction applied, was found to be 0.82, indicating satisfactory internal consistency.

#### SUBJECTS

For this study a sample of 1249 men was used, all of whom were volunteers for the Submarine Service. Scores for these men were available on the General Classification Test (GCT), Arithmetic (ARI), Mechanical (MECH), and Clerical (CLER) tests as well as on the Personal Inventory Barometer (PIB), a questionnaire designed to measure the frequency and severity of neurotic traits (9), and the Self-Reported Motivational Questionnaire (SMQ). Two additional scores were obtained by combining the standard scores on the GCT and MECH tests and the ARI and MECH tests. Although under certain conditions waived, a cut-off score of 100 on the ARI plus MECH was in effect at the time of this study.

In the group of 1249 volunteers there were 411 rated and 838 non-rated men. There were 1100 graduates from the Submarine School and 149 men who failed (drops).<sup>3</sup> These "drops" were categorized as academic failures, de-volunteers, and psychological drops, the latter being an overlapping category consisting mainly of marginally-adjusted men from the psychiatric standpoint.

Approximately two-thirds of the enlisted volunteers for the Submarine Service are

<sup>1</sup> Three items not applicable to all volunteers since they dealt with the attitudes of the individual's wife or with previous submarine experience were, therefore, not included.

<sup>2</sup> The mechanics of this part of the item analysis involved the use of the Chi-square technique with 1 or 2 degrees of freedom, depending on the number of categories used.

<sup>3</sup> The N of 1249 does not include those volunteers who were disqualified for "physical" reasons, obesity, poor visual acuity and so on. Deleted also were those men with insufficient obligated service.

non-rated. As might be expected, the Submarine School Attrition rate for the older, more experienced rated men is disproportionately lower. Table I demonstrates the reliability of this relationship for the present sample of 1249 enlisted men ( $P$  of  $X^2 < .01$ ).

Table I.—The Relationship of Attrition Rate to Rated and Non-Rated Submarine School Volunteers.

	Drops		Graduates		Total
	N	%	N	%	
Rated	34	8	377	92	411
Non-Rated	115	14	723	86	838
Total	149	12	1100	88	1249

From the data in Table I, it seems apparent that using the Drop-Graduate criterion (irrespective of rating status) in the validation studies to follow would quite probably attenuate the predictive validity of the tests constituting the assessment battery at the time of this study. As a result, most of the validation data to follow contain separate analyses for rated and non-rated men making up the total population sample. In effect then, we are assuming that maximal validity of our test will only be realized if separate prediction formulae are derived for rated and non-rated men.

Table III—Comparison of Basic Battery Test Scores, SMQ, and PIB for Rated and Non-Rated Graduates and Drops in Enlisted Submarine School.

Test	Rated (N = 411)					Non-Rated (N = 838)					Total (N = 1249)	
	Graduates (N = 377)		Drops (N = 34)		P of CR	Graduates (N = 723)		Drops (N = 115)		P of CR	Mean	S.D.
	Mean	S.D.	Mean	S.D.		Mean	S.D.	Mean	S.D.			
SMQ	157.49	27.92	142.06	33.38	.01	147.09	28.56	144.57	33.30	N.S.	149.6	30.7
PIB	86.48	50.38	104.79	66.35	N.S.*	104.27	56.49	123.41	68.28	<.01	100.7	57.2
GCT	56.04	8.08	50.68	7.26	<.001	59.64	7.31	54.11	7.37	<.001	57.8	7.9
ARI	53.56	8.37	49.18	10.27	<.05>.01	57.30	7.19	53.77	7.13	<.001	55.6	7.9
MECH	55.39	7.70	52.18	8.40	<.05>.01	56.44	7.53	53.02	6.33	<.001	55.7	7.6
CLER	50.84	7.86	46.79	8.17	<.01	51.31	7.74	48.79	7.71	<.01	50.8	7.9
GCT + MECH	111.31	13.37	103.47	13.59	<.01	115.98	12.27	107.22	10.76	<.001	113.4	13.0
ARI + MECH	108.95	13.39	101.71	16.29	<.05>.01	113.60	11.33	106.48	9.99	<.001	111.2	12.4

\* N.S. indicates non-significant, for the purpose of this study nul-probability greater than 5%.

## RESULTS

### Subgroup Differences in Test Score Patterns.

The first research question to be answered centered around the identification of those test scores which reliably discriminated between the criterion groups, i.e., those who fail (drops) and those who graduate from Submarine School (graduates). Including the total sample irrespective of rating status, Table II contains the means and standard deviations for the six tests and two combination scores, for the graduates and drops, as well as the critical ratios for the differences between the means of the two groups.

The data in Table II show reliable differences for all of the tests in the battery. Accordingly, those men who fail Submarine School tend to have lower basic battery

Table II—Comparison of SMQ, PIB and Basic Test Battery Scores for Total Group of Enlisted Men Graduating from and Failing in Submarine School

Test	Graduates (N = 1100)		Drops (N = 149)		Critical Ratio (CR)	P of CR
	Mean	S.D.	Mean	S.D.		
SMQ	150.65	28.79	143.99	33.37	2.32	.02
PIB <sup>a</sup>	98.17	55.13	119.16	68.30	3.60	<.001
GCT	58.41	7.74	53.33	7.47	7.26	<.001
ARI	56.02	7.81	52.72	8.20	4.71	<.001
MECH	56.08	7.60	52.83	6.85	4.64	<.001
CLER	51.15	7.78	48.34	7.82	4.01	<.001
GCT+MECH	114.38	12.83	106.36	11.61	8.02	<.001
ARI+MECH	112.00	12.37	105.39	11.91	6.61	<.001

<sup>a</sup> Low scores have been shown to be indicative of more adequate adjustment (9).

scores, to be less strongly motivated (low SMQ scores), and to be generally less adequately adjusted (high PIB scores).

The question arises as to whether these differences remain for both rated and non-rated men. Table III presents the data necessary to examine this question.

These data show, for the most part, that the test score differences between the means of the tests remain both within the rated and non-rated groups. This is true except for the PIB and SMQ scores. Thus, SMQ scores are reliably predictive of Submarine School graduation **only** in a rated population, whereas PIB scores are reliably predictive of the same criterion **only** in a non-rated group. It should be noted, however, that although not satisfactorily reliable, the direction of the differences between the scores on both the PIB and SMQ remain for both rated and non-rated groups.

It is interesting to note in Table III that both within the graduate and within the drop groups the scores of rated and non-rated men appear to be systematically different. By use of the critical ratio technique to check the reliability of these differences, it was disclosed that rated graduates obtained higher SMQ and lower PIB scores than the non-rated graduates. On the other hand, non-rated graduates receive higher Basic Test Battery scores (with the exception of Clerical) than do the rated gradu-

ates. However, within the drop group, non-rated men received significantly higher scores than the rated men only on the GCT and ARI tests.

One variable which, in part, may be associated with the higher Basic Test Battery scores of the non-rated population was that they had received more years of formal education than had the older, rated men. To examine this possibility, the total group was divided on the basis of education. It was found that 70.6% of the rated volunteers had 12 or more years of education and 29.4% less than 12 years. Within the non-rated group on the other hand, 83.3% had 12 or more years of education and 16.7% less than 12 years. Relating educational attainment to success in Submarine School shows that 9.7% of the high education group and 31.2% of the lower education group fail to graduate.

The data given in Table IV show significant differences in the same direction as appeared in Table III between the rated and non-rated test score means (except for MECH and CLER) within both the "high" and "low" education groups. This finding argues in the case of the GCT and ARI test that the higher mean scores obtained by the non-rated men are not accounted for by the differences in education of the two groups, though the differences do exist (see above). These data may, in part, be explained by the fact that rated men were

Table IV.—Comparison of PIB, SMQ and Basic Test Battery Scores for Rated and Non-Rated Volunteers in High and Low Education Groups.

	12 Years and Above—Education					Below 12 Years Education				
	Rated (N = 290)		Non-Rated (N = 698)		P of CR	Rated (N = 121)		Non-Rated (N = 140)		P of CR
	Mean	S.D.	Mean	S.D.		Mean	S.D.	Mean	S.D.	
SMQ	155.97	28.57	147.70	28.63	<.001	156.82	28.97	146.64	31.83	<.01
PIB	85.78	50.48	106.23	56.75	<.001	93.30	55.53	110.21	67.34	<.05 >.02
GCT	57.26	7.78	59.90	7.19	<.001	51.63	7.47	53.80	7.30	<.02 >.01
ARI	54.86	8.28	57.68	6.98	<.001	49.22	8.08	52.54	6.98	<.001
MECH	55.96	7.95	56.37	7.61	N.S.	53.12	7.11	53.95	6.58	N.S.
CLER	51.54	7.92	51.54	7.73	N.S.	48.01	7.60	48.10	7.41	N.S.
GCT+MECH	113.16	13.25	116.18	12.30	<.001	104.69	12.09	107.79	10.65	<.05 >.02
ARI+MECH	110.83	13.46	113.91	11.36	<.001	102.37	12.61	106.18	9.71	<.01

administered the Basic Test Battery a number of years ago when the tests were less standardized. Moreover, at that time emphasis on the tests as criteria for advancement was probably not as great as it is currently.

Significant differences were also found when comparing the high and low education groups, irrespective of the rated, non-rated classification, for all tests except for the PIB and SMQ. This result suggests that these personality and motivation test scores are not affected by education, but seem to be systematically related to whether or not a man is rated ( $P < .001$ ), since rated men consistently obtain higher SMQ and lower PIB scores.

#### Reliability and Validity of the SMQ.

The reliability of the SMQ was estimated by the computation of a split-half (odd-even) correlation coefficient, using a random sample of 235 volunteers obtained from the total group of 1249. As a result, a correlation coefficient, corrected by the Spearman-Brown formula, was found to be 0.86, indicating the internal consistency of

the questionnaire. In addition, a retest reliability coefficient of 0.66 was obtained with a sample of 182 enlisted men tested before and after the 8-week basic submarine course. This finding indicates the acceptable, yet not optimal, stability of the SMQ test scores in their present form.

Using Submarine School attrition as the validation criterion necessitated controlling for those variables known to affect criteria of this sort. By far the most important principle for motivational research, particularly where an achievement or performance criterion is employed, is that whenever performance is studied, motivation must be held constant and whenever motivation is studied, ability (to perform) must be controlled (12). This principle was applied to the problem of assessing the validity of the SMQ with respect to Submarine School attrition.

Assuming then that both motivation (SMQ scores) and ability (Basic Test Battery Scores)<sup>4</sup> were related to the criterion, the question arose as to possible interrelationships of the SMQ and battery scores. The percentage ogive presented in Figure 1

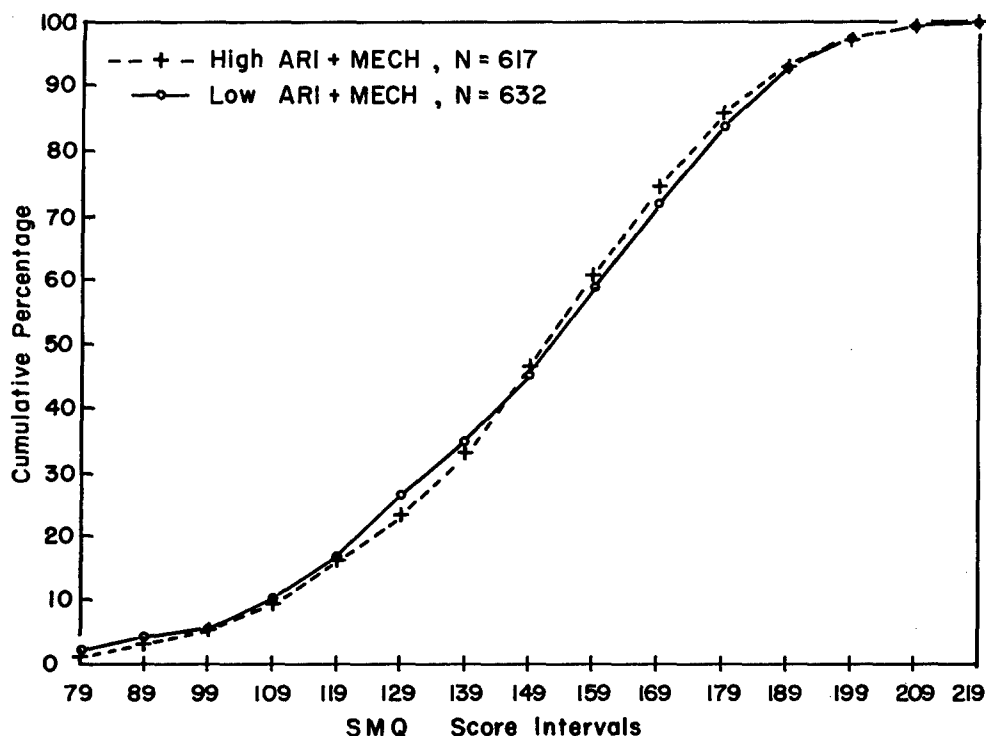


FIGURE 1. RELATIONSHIP BETWEEN ABILITY AND MOTIVATION (SMQ) SCORES

shows the relationship between high (Mean ARI + MECH = 121.38, S.D. = 6.80) and low (Mean ARI + MECH = 101.41, S.D. = 7.90) ability groups and motivation scores. These groups were obtained by splitting the sample at the median of the combined Arithmetic and Mechanical (ARI + MECH) scores for the total population (N = 1249).

Obviously, the virtual superimposability of the two ogives in Figure 1 suggests that the SMQ and ARI + MECH scores are only slightly, if at all, interrelated. However, comparing the relationship of SMQ scores to the Drop-Graduate criterion for the "high" and "low" ability groups identified in Figure 1 shows the importance of the motivation-ability interaction. Table V contains these data.

Table V.—The Relationship of ARI + MECH and SMQ to Attrition for Enlisted Submariners.

		Graduates	Drops	P of X <sup>2</sup>
High ARI + MECH	High <sup>a</sup> SMQ	282 (93%)	22 (7%)	N.S.
	Low SMQ	289 (92%)	24 (8%)	
Low ARI + MECH	High SMQ	275 (87%)	41 (13%)	<.05 >.02
	Low SMQ	254 (80%)	62 (20%)	
Total		1100	149	N = 1249

<sup>a</sup> "High" and "low" refers to above and below the Median of the score distributions, respectively.

The data in Table V indicate that the probability to be dropped from Submarine School is significantly greater for those enlisted men with "low" SMQ scores but **only** if they fall in the low ability group identified by the ARI + MECH scores.

The question could be raised as to the grossness of the "median-splits" used to identify the "high" and "low" motivation and ability groups in Table V. That being the case, the distributions (in ogive form) for the drops and graduates were prepared separately for the "low" and "high" ability groups. Figures 2 and 3 contain these curves.

It should be pointed out at the outset that the critical ratios for the differences between the SMQ means within both the high and low aptitude groups were significant at the .05 level (one tail test). The curves demonstrate that the distributions of SMQ scores for those who fail Submarine School tend to be systematically lower in terms of the motivation score for both the "low" (Figure 2) and "high" (Figure 3) ability groups. Although somewhat contradictory to the findings in Table V, it appears that a "cut-off" score on the SMQ scale would be more efficacious for the "high" than the "low" ability groups. Thus, although based

<sup>4</sup> The combined ARI and MECH score was used in this context, since this score has been shown to be slightly more highly correlated with the criterion than any other combination (11).

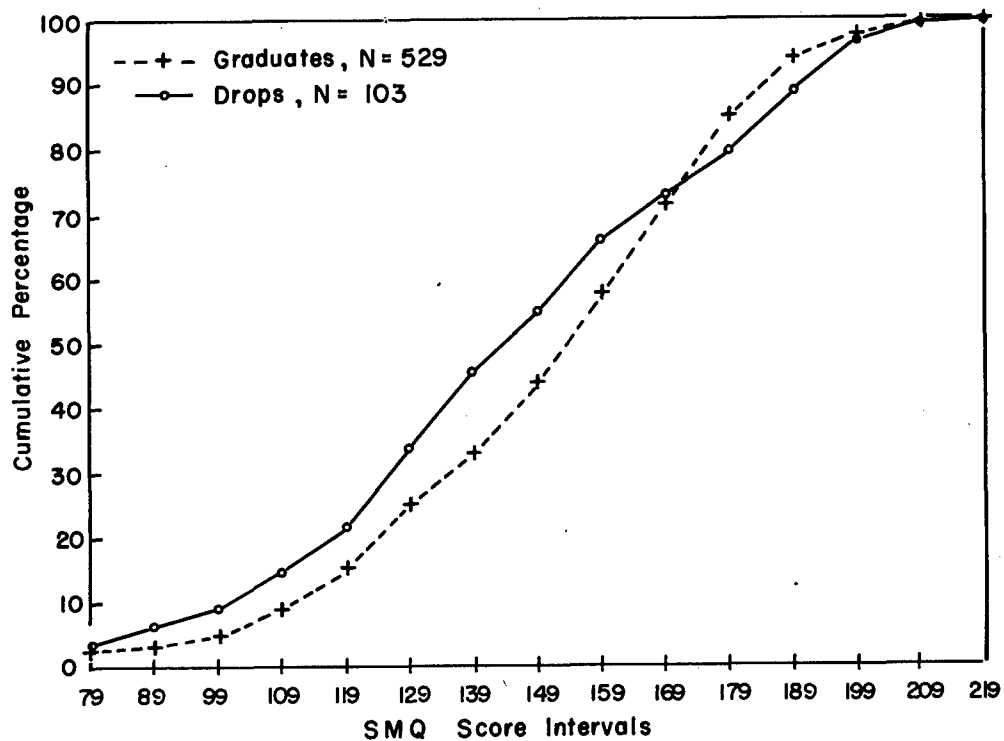


FIGURE 2. RELATIONSHIP BETWEEN ATTRITION AND MOTIVATION (SMQ) SCORES FOR THE LOW ABILITY GROUP

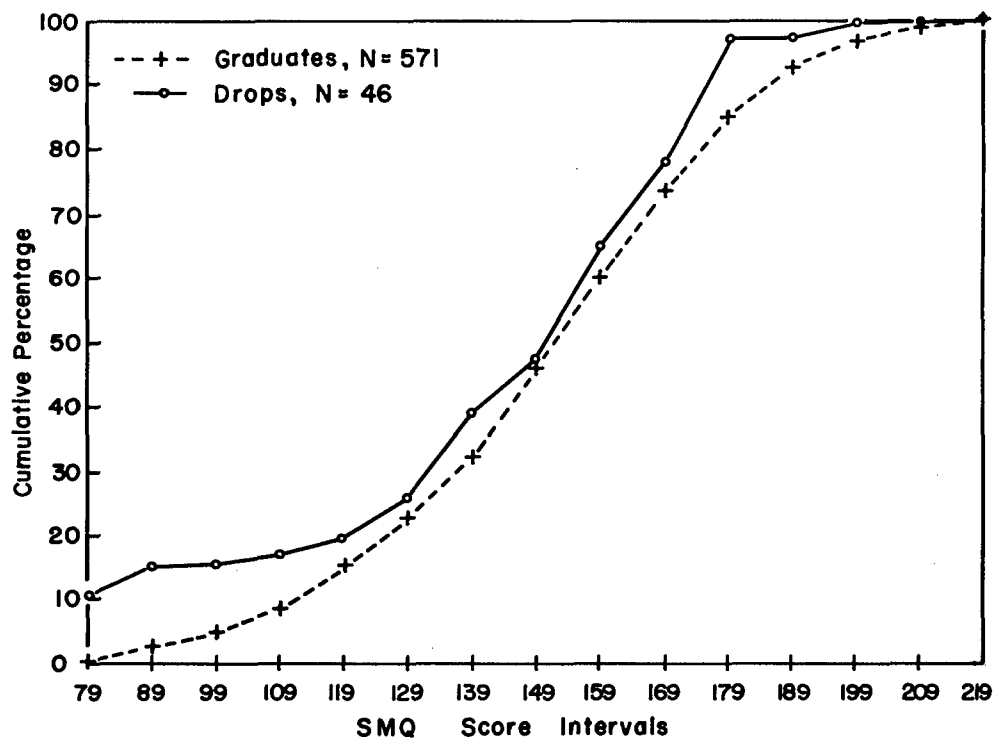


FIGURE 3. RELATIONSHIP BETWEEN ATTRITION AND MOTIVATION (SMQ) SCORES FOR THE HIGH ABILITY GROUP

upon 46 drops only, it appears from Figure 3 that the rejection of all volunteers with an SMQ score below 89 would result in the elimination of the 15% of those who would fail Submarine School but at a "cost" of losing 2.5% of those who would have graduated. Comparable percentage statistics for the curves in Figure 2 are 7% and 3.6% in the same order. However, more convincing validation information for the SMQ with respect to this criterion is needed before any cut-off procedure would seem to be practicable.

Following the procedure used in the preliminary validation of the SMQ with a submariner officer population (1), the interactional effects of psychiatric status (PIB)<sup>5</sup>, motivation (SMQ), and ability (ARI + MECH) upon Submarine School attrition were next examined. Table VI contains these data.

In the first place, it appears that within each of the four PIB-Ability groupings (A, B, C, and D in Table VI) there is no reliable increase in the probability to drop in Sub-

marine School associated with a low SMQ score. However, consistent with the finding in Table V, the bias in favor of lower attrition for those with high SMQ scores approaches significance for the low ability group irrespective of the PIB category (C and D in Table VI).

Looking at the rows of data (across PIB groups) in Table VI, it appears that the groups with high PIB scores obtain systematically higher attrition rates within each SMQ and ability group. As for the ability alone, i.e., within each SMQ and PIB group separately, it is seen in Table VI that the groups with high ARI + MECH scores show a consistently lower attrition rate.

Finally, those men falling in the category of low ability, high PIB and low SMQ show an attrition rate of 22.3% as compared to those falling into the group with the reverse score pattern who show an attrition rate of 4.1% ( $P$  of  $X^2 < .001$ ). The above discussion indicates, at least tentatively, the useful validity for the SMQ as a predictor of Submarine School attrition, in particular, if the

Table VI.—The Interaction of PIB, SMQ, and ARI + MECH Upon Attrition Rate in Basic Submarine School.

	Low PIB			High PIB			Total
	Graduates	Drops	% Drop	Graduates	Drops	% Drop	
High <sup>a</sup> SMQ	187	8	4.1	95	14	12.8	304
High ARI + MECH	(A) <sup>b</sup>			(B)			
Low SMQ	117	4	3.3	172	20	10.4	313
	P of $X^2$ N.S.			P of $X^2$ N.S.			
High SMQ	165	19	10.3	110	22	16.7	316
Low ARI + MECH	(C)			(D)			
Low SMQ	104	19	15.4	150	43	22.3	316
	P of $X^2$ N.S.			P of $X^2$ N.S.			
Total	573	50	8.0	527	99	15.8	1249

<sup>a</sup> "High" and "low" refers to above and below the Median of the score distributions respectively.

<sup>b</sup> Upper case letters identify the four cells of the table.

<sup>c</sup> PIB, the Personal Inventory Barometer, as mentioned earlier in this study was designed, and partially validated, as a means to identify poor psychiatric risks to be rejected for the Submarine Service.

psychiatric status (PIB score) and ability (ARI + MECH) are also taken into account.

### The Relationship of SMQ to Achievement Level in Submarine School.

The relationship of motivation, as measured by the SMQ, to class standing (in stanine form) was investigated within high and low ARI + MECH groups obtained as before. Table VII contains the relevant data.

Table VII.—The Interaction of Class Standing (Stanine), SMQ and ARI + MECH for Enlisted Sub School Volunteers<sup>a</sup>

	Stanine				P of X <sup>2</sup>
	1-5		6-9		
	N	%	N	%	
High SMQ	181	46	151	54	N.S.
High ARI+MECH (N = 571)					
Low SMQ	134	46	155	54	
High SMQ	190	69	85	31	.01
Low ARI+MECH (N = 529)					
Low SMQ	210	83	44	17	
Total	665	60	435	40	N=1100

<sup>a</sup> The N of 1249 is reduced by the 149 men who were dropped from Submarine School

From Table VII it is seen that there is no significant relationship between Submarine School achievement level and SMQ scores for the high ability (above median) group. On the other hand, this relationship is highly significant for the low ability groups.

Pearson product-moment correlation coefficients were computed between the SMQ scores and the seven other test scores, using a random sample of 328 taken from the total group. The correlational statistics computed between SMQ and the Basic Battery Tests all approached zero. This finding indicates that the motivation questionnaire may be measuring aspects of the personality that are not being tapped by the other measures. However, the correlation of SMQ with PIB was -0.44. This finding suggests that a more stable personality structure, as shown by a low PIB score, is related to high motivation in this group of submarine volunteers, and conversely, that a less stable personality would probably be found in a person who is less motivated for the submarine service.

## INTEGRATIVE SUMMARY AND DISCUSSION

The goals of this study were to investigate the reliability and validity of scores obtained from an experimental test of motivation for the Submarine Service. The scores on the Self-Reported Motivational Questionnaire (SMQ) used in this study resulted from the application of a key derived by three separate item analyses. A total of 1249 enlisted men were included in the population sample.

The results indicated that the SMQ score was usefully reliable. Moreover, using Submarine School attrition as the criterion, the SMQ scores proved usefully valid **only** within the half of the population with aptitude test scores (Arithmetic + Mechanical) below the median for the total population. Similarly, the final rank order of the 1100 Submarine School graduates was significantly correlated with SMQ **only** for the "low" aptitude group.

These results indicate that individual differences in motivation, at least as indicated by the SMQ scores used in this study, are usefully predictive of success in Enlisted Submarine School—but only for the population sub-group with below-average ability. On the surface, this finding seems meaningful inasmuch as a person with marginal ability must, it would seem, "try harder" to succeed in most educational situations.

Another explanation is possible, however. The SMQ appears to be quite "transparent" in that the respondent could, if he desired, respond to the items in the way "he thought he should" irrespective of the validity of his responses. Continuing this argument, Submarine School graduates may "distort" their responses to obtain a high SMQ score more than do those who fail in school. In turn, the men with high aptitude apparently "see through" the test and distort more than those in the low aptitude group. Arguing against this explanation, however, is the virtual equivalence of the SMQ distributions for the high and low aptitude groups (Figure 1).



Another argument might be advanced counter to the notion that "faking" may account for high SMQ scores. If a person distorts responses in order to give the impression he is highly motivated, then it seems reasonable to assume that the respondent is motivated for the vocational choice for which his motivation is being evaluated. In short, the argument advanced here is that a high SMQ score indicates high motivation for the Submarine Service whether or not the responses were distorted in a socially desirable direction. An equally important question not answered in this study is whether low SMQ scores indicate low motivation for the service.

In the process of analyzing the test data used in this study it was found that the test profiles (including the SMQ) differed for rated men as compared to non-rated men. (Table III). For the most part, these differences persisted with educational level controlled (Table IV). Future studies of this type should involve separate analyses for the rated or non-rated men included in the population sample.

What logical outgrowths of this study are indicated? First of all, it would seem presumptuous to think that motivation for a professional career such as the Submarine Service is unidimensional. The point raised here pertains to the factorial content of the SMQ score. The keyed items making up the SMQ score may be measuring uncorrelated

aspects of motivation and therefore should not be summed. Too, items "tapping" other important attitudes added to the questionnaire may enhance the validity of the score.

It is quite possible that the overall approach to motivational measurement used in this study may be inappropriate. The responses to the SMQ items can be, and probably are, distorted. We have argued that "faking motivation" may indicate motivation. This may not be the case. However, a forced-choice version of the SMQ is now being prepared with a view toward controlling fabrication of responses.

Another approach to motivational measurement seems plausible. Instead of asking the respondent to indicate the relative strength of his needs, attitudes, and goal values, ask the subject to indicate the relative probability that selected environmental obstacles (failure on a test, for example) would reduce the strength of the prepotent motives operating at the time. This approach assumes that individuals who perceive the obstacles as less threatening are the most highly motivated.

All in all, the results of this study indicate that the SMQ in its present form may be a start in the right direction. Motivation as measured by the SMQ is related to Submarine School attrition and achievement level in the lower ability groups at least. The SMQ scores, therefore, can be used to a limited degree for predictive purposes.

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## **APPENDIX A**



## **APPENDIX B**

## APPENDIX B

### SMQ QUESTION SHEET (Keyed items indicated by + or —)

#### SMQ (Form 2)

INSTRUCTIONS: You have just used the 9-point scale as a means of describing yourself. We are asking you to apply THE SAME SCALE to some additional items. Use the additional answer sheet provided.

Your response to these items will assist us in understanding your progress in the Submarine Service.

THERE ARE NO RIGHT OR WRONG ANSWERS. We would appreciate your frank and honest responses to each item.

- |  |   |
|--|---|
| 1. One of the main reasons I volunteered for submarines is to be with my friends who also volunteered.                 | +13. I feel that submarine duty is the most dangerous in the Navy.  |
| + (a) 2. I feel that being a member of a submarine crew offers an excellent opportunity to acquire many close friends. | +14. I feel that life in the U.S. Navy is the best life for me.   |
| — (b) 3. At times I am not sure I should have volunteered for submarines.  | 15. Information obtained from reading popularized submarine stories greatly influenced me to volunteer for submarines.                  |
| 4. I feel that my wife is glad I am going into submarines. (Omit if you are not married.)                              | +16. I feel that a submarine crew is an excellent example of a very high morale group.  |
| + 5. I would like eventually to get into Nuclear-powered missile-firing submarines.                                    | +17. I am confident that I will have no trouble passing the Pressure Chamber Test.  |
| 6. I believe that there is much more opportunity for advancement in submarines than in any other branch of the Navy.   | 18. I feel that my wife is very concerned about the dangers of radiation exposure aboard the Nuclear submarines. (Omit if not married.) |
| + 7. I volunteered for submarines because it is the best way to learn nuclear engineering.                             | —19. I volunteered for submarines without knowing much about how submariners live.  |
| + 8. I expect Sub. School to be easy for me.   | 20. I believe that all one has to do to be a qualified submariner (and wear dolphins) is to graduate from Submarine School.             |
| 9. Information given me by a qualified submariner influenced me to volunteer for submarines.                           | +21. I believe that even if submariners did <b>not</b> get extra pay, I would have still volunteered.                                   |
| +10. I feel that getting into submarines is one of the most important events of my life.                               | +22. I believe the chow the submariners eat is the best you'll find anywhere in the Navy.   |
| 11. Ordinarily, I would much rather wear my uniform than civilian clothes in public.                                   | +23. My ultimate goal in volunteering is to get into Nuclear submarines.  |
| +12. I feel certain I'll get through Sub. School.  |   |

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SMQ (Form 2) (cont'd.)

- 24. I feel that one of the most important advantages of being a submariner is to be looked up to by the other men in the Navy.
- +25. I am confident that I will have no trouble passing the Escape Tank Training.
- +26. I believe my family will be proud of me when I graduate from Submarine School.
- 27. I would not be greatly disturbed if I didn't get through Submarine School.
- 28. I believe that submariners are the most highly respected men in the Navy.
- +29. I have done a great deal of reading about submarines.
- +30. I volunteered for submarines after thinking it over for a long time.
- +31. Being able to wear dolphins after I am a qualified submariner will be very important to me.
- 32. I feel that one of my main reasons for volunteering is to be a member of a group of very high-caliber fighting men.
- 33. I feel that the Submarine School training almost completely eliminates the real dangers of submarining during peacetime.
- +34. I feel that the specialized training one can get in Submarine School is as good or better than one can get on the outside.
- 35. I am not at all sure I would make a good submariner.
- +36. I would have still volunteered for submarines even if it meant extending my enlistment two or more years.
- +37. I feel that my parents are glad I am going into submarines. (If parents are not living, answer how you think they would feel.)
- 38. The hazardous duty pay was the most important reason for volunteering for submarines.
- +39. The thought of staying submerged 60 days or longer is not the least bit threatening to me.
- 40. I believe that being a member of the crew of a Nuclear submarine even during peacetime is hazardous for a man who wants to raise a family.
- 41. I believe there is considerable glamour attached to being a submariner.
- 42. The excitement associated with submarining is one of the main reasons I volunteered.
- 43. I liked my first trip on a submarine very much. (Leave blank if you have never taken a "dive" in a submarine.)
- +44. I would make a good submariner.
- +45. Taking orders from superiors never bothers me.
- 46. I believe that modern submarines can safely go as deep as 1200 feet.
- 47. I believe that the danger of radiation exposure aboard Nuclear submarines is very serious even during routine operations.
- +48. Should I fail in Submarine School, I would be very badly disappointed.
- 49. I volunteered for submarines on the spur of the moment, without thinking much about it.
- +50. I feel that the publicity received by the crews of the Nuclear submarines is one good reason for volunteering for the Submarine Service.

(a) + positively scored items

(b) — negatively scored items

Accession No.

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U.S. Naval Medical Research Laboratory, U.S. Naval Submarine Base, Groton, Connecticut. REPORT NO. 348, THE SELF REPORTED MOTIVATIONAL QUESTIONNAIRE (SMQ): A Preliminary Validation Study with a Population of Enlisted Submariner Volunteers, Feb '61.

Rpt. No. 3 on Subtask (2) of Bureau of Medicine and Surgery Research Project MR005.14-2100, 12 pp., plus iii, 7 tables, 3 figs., 13 refs., and Appendices A and B.

The construction and keying of a Self-Reported Motivational Questionnaire (SMQ) are described. With enlisted Submarine School volunteers, the scores are related to attrition in Submarine School. These relationships are presented with several breakdowns such as rated/non-rated, high/low scores on the Basic Battery Test, and are described in detail. The discussion of the reliability and validity of the SMQ concludes that the scores are usefully reliable, and that they are usefully valid for that portion of the population whose aptitude score (ARI + MECH) is below the median for the total population. The final academic rank order of the 1100 Submarine School graduates studied is significantly correlated with the SMQ only for the "low" aptitude group.

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1. Motivation test (pencil-and-paper)
2. Screening test for aptitude for success in submarine training.

I. Rubin, Barbara

II. Parker, James W.

DISTRIBUTION: Copies are obtainable from USN MRL, Groton, Conn. and also from DSC ASTIA, Wash., D. C.

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